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Profitability of tomato (*Solanum lycopersicum*) cultivation in Nuh district of Haryana

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ABSTARCT

The present study was carried out during 2017–18 on the basis of of highest production of tomato (*Solanum lycopersicum* L.) in Nuh district of Haryana. The study was carried out to examine the cost and returns, marketing cost, margins, price spread and marketing efficiency of tomato through different channels. A sample of 30 tomato growers was taken purposively from various villages in Tauru block of Nuh District of Haryana. There was regular variation in price of tomato due to its semi-perishable nature and immediate postharvest sales by the cultivators. The study revealed that direct marketing of tomato was found to be most profitable in Channel–IV, i.e. Producer-consumer among all other prevalent marketing channels due to the non-existence of intermediaries between producer and ultimate consumer. Study concluded that the estimated total costs, gross returns, net returns, and B: C ratios of tomato cultivation were ₹183474, 289248, 105774 and 1.58 per ha, respectively.

Keywords: B:C ratio, Marketing efficiency, Production, Returns, Tomato

Tomato (*Solanum lycopersicum* L.) is the world's largest vegetable crop and known as protective food because of its special nutritive value. Tomato is one of the most important vegetable crops cultivated for its fleshy fruits. Tomato is considered as important commercial and dietary vegetable crop. It is protective supplementary food. As it is short duration crop and gives high yield, it is important from economic point of view and hence area under its cultivation is increasing over the years (Gadhethariya *et al.* 2020). Cash crops cultivation plays an important role in the agricultural economy of India. Marginal, small, medium and large size farmers of India grow vegetable for generating income and increasing nutrient in the diet of people. The area, production, and productivity of tomato in Haryana were 34.90 thousand ha, 746.02 thousand tonnes and 21.37 tonnes per ha respectively during 2017–18. In Haryana, it is grown mainly in the districts like Nuh, Kurukshetra, Yamunanagar, Karnal, Sonepat, Ambala, Panchkula, Panipat, Rohtak, Jind and Sirsa (Directorate of Horticulture 2018). The estimation of the cost of cultivation return is very important in farm economics as it helps in decision making at various levels for the farmers, researchers, policy makers, bankers and the administrators. The enterprise cost study also provides very useful information of practical value in improving the farm efficiency (Sharma and Singh 2020). Tomato is perishable and the excess of production was either to be processed or cold-stored for further consumption, which otherwise would lead to the problems in marketing of the product due to glut associated with price fluctuations (Sharma and Singh 2011).

The fluctuation in prices are generated by speculative activities of intermediaries, sharp increase in the price after the bulk of produce has moved up into the whole sale market channels serving neither the interests of the producers of the ultimate consumers. It will be imperative to study the market structure of the tomato to safe guard the interest of the producers as well as consumers of the state. As tomato is semi perishable in nature; profitability of tomato production depends upon the marketing cost, margins and price behavior of the produce (Kumar *et al.* 2020).

MATERIALS AND METHODS

The present study was conducted in Nuh district of Haryana on the basis of highest production of tomato. The Tauru block was selected for collection of data and further 30 tomato growers from various villages were selected randomly for this study. The primary data for the agriculture year 2017–18 were collected by conducting personal interviews of the selected farmers with the help of specially designed schedule. For estimating marketing cost, margins and price spread of tomato, one main market (Tauru) on the basis of maximum arrival of tomato was identified from Nuh district.

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Valuation of farm input: The valuation of farm inputs such as human labour, seed, manures and fertilizers, insecticides and pesticides, irrigation charges etc. were calculated according to the actual expenses incurred at the prevailing market price at which these inputs were available to the growers.

Valuation of output: Valuation of farm output was estimated made on the basis of average price of each seasonal crop.

Total variable cost: Variable cost contains various items, i.e. human labour, seed, manures and fertilizer, insecticides and pesticides, irrigation charges, interest on working capital @ 7% per annum.

Returns over variable cost: The returns over variable cost were worked out after deducting the total variable cost from gross income. It was also used in judging the relative importance of each component of variable cost.

Return over variable cost = Gross income - total variable cost

Evaluation of marketing system: The different market functionaries such as wholesaler cum commission agents, village trader, retailers and consumers were randomly selected from the Tauru market. The data collected from the different market functionaries were analyzed to estimate the marketing costs and margins through important marketing channels.

Marketing margins and costs of tomato: To find out the marketing margins and costs for different channels, ten wholesalers-cum-commission agents, fifteen village traders and fifteen retailers were selected randomly from the Tauru market. The relevant data were collected with the help of pre tested, well designed schedule. Information regarding marketing aspects of tomato was collected from the producers and the retailers in order to find out the producer's share in the price paid by the consumers. The main channel in operation in the marketing of tomato was studied to work out the price spread.

Marketing functionaries/agencies: The persons involved in handling the produce from the producer to the final consumer are termed as market functionaries. The main market functionaries involved in the marketing of vegetables were arhatiyas, contractors, village trader, wholesalers, retailers, processing agent, palledars, weighman etc.

Village level trader: This class consists of traders of the local market or even village merchants. They also purchase standing crop of the farmer and sell it in the local market or in terminal market.

Wholesalers: Wholesalers refer to those traders who sell and purchase the vegetables in very large trade. They generally perform the function of assembling, storing, grading, risk bearing and marketing finance.

Retailers: Retailers purchase the vegetables from the wholesalers, at wholesale price and sell it to the consumers. In general, they perform the function of storing, and distribution of the produce to the consumers. The profit earned by the retailer in buying and selling the produce is known as retailer's margin.

Producer's share in consumer's rupee

It is the percentage of the net price received by the producer to the price paid by the consumer or selling price of retailer. The producer's share in the consumer's rupee was worked out as under:

$$Ps = \frac{P_F}{P_C} \times 100$$

where, P_s, Producer's share in consumer's rupee; P_F, Price of the produce received by the farmer; P_c, Price of the produce paid by the consumer.

Marketing efficiency

The ratio of the total value of goods marketed to the total marketing costs is issued as a measure of efficiency. The higher the ratio, the higher is the efficiency and vice-versa. The marketing efficiency of different marketing channels was worked out by using the following method.

(a) Shepherd's method

$$ME = RP \div MC$$

where, RP, Retailer's sale price or consumer's purchase price; MC, Total marketing costs.

(b) Acharya's method (Acharya and Agarwal 2011)

$$MME = FP \div (MC+MM)$$

where, FP, Net price received by farmer, MC, Total marketing costs, MM, Total net margins of intermediaries .

(c) Conventional method (Acharya and Agarwal 2011)

$$ME = [O/I] \times 100$$

where, O, Output is the value added; I, Input is the real cost of marketing; ME, Marketing efficiency.

RESULTS AND DISCUSSION

Cost and returns of tomato cultivation: Table 1 represents that per ha gross returns from tomato was ₹ 289248. The return over variable cost was ₹ 177039 with a net return of ₹ 105774. The average production from tomato was found to be 393 q/ha and the cost of production per q was estimated ₹ 467. The major cost components in tomato were the transportation ₹ 22339 per ha which accounted for (12.58%) of total cost followed by transportation ₹ 21981 that contributed (10.38%), rental value of land ₹ 21767 which constituted (11.86%), picking ₹ 20792 that contributed (11.33%), total fertilizer ₹ 16654 which constituted (9.08%), plant protection ₹ 14683 which was (8.00%) earthing up ₹ 9867 that constituted (5.38%), hoeing and weeding ₹ 8833 which contributed (4.81%) irrigation ₹ 8050 which contributed (4.39%) and preparatory tillage ₹ 6542 that accounted (3.57%). The B:C ratio in tomato was found to be 1.58. Our results confirms that of Tambe *et al.* (2018) who found the average per ha cost of cultivation of summer tomato was ₹ 259279.62. The average production of ₹ 980.08 q/

Table 1 Cost and returns of tomato production in Nuh district of Haryana

	Value (₹/ha)	%
Inputs		
Preparatory tillage	6542	3.57
Pre-sowing irrigation	908	0.49
Seed/Nursery raising	6017	3.28
Seed treatment	633	0.35
Sowing/Transplanting	3013	1.64
Ridging	2461	1.34
FYM	4583	2.50
Fertilizer nutrients		
(a) Urea	2368	1.29
(b) DAP	11600	6.32
(c) Potash	1215	0.66
(d) $ZnSO_4$	338	0.18
(e) NPK	1133	0.62
Total fertilizer invest	16654	9.08
Fertilizer application cost	1041	0.57
Irrigation	8050	4.39
Hoeing/Weeding		
(a) Chemical		
(b) Manual	8833	4.81
Earthing up	9867	5.38
Plant protection	14683	8.00
Picking charges	20792	11.33
Miscellaneous	791	0.43
Total (1 to 15)	104868	57.16
Interest on working capital @ 7%	7341	4.00
Variable cost	112209	61.16
Packaging charges	4717	2.57
Transportation	22339	12.18
Management charges @ 10%	11221	6.12
Risk factor @ 10%	11221	6.12
Rental value of land	21767	11.86
Total cost	183474	100
Production (q/ha)	393	
Price received (₹/q)	736	
Gross return	289248	
Return over variable cost	177039	
Net return	105774	
Cost of production (₹/q)	467	
B:C ratio	1.58	

ha of main produce was obtained from summer tomato. The gross returns obtained were ₹ 470793.91 at the overall level with B: C ratio 1.82.

Following four major marketing channels were identified in the study area in marketing of tomato crop.

I. Producer→ Village trader → Wholesaler cum commission agent→ Retailer → Consumer
II. Producer → Wholesaler cum commission agent → Retailer → Consumer
III. Producer → Retailer → Consumer
IV. Producer → Consumer

Price spread of tomato

Channel -I: Producer→ Village trader → Wholesaler cum commission agent→ Retailer → Consumer

In this channel, three intermediaries were involved between producers and ultimate consumers in the Nuh district of Haryana. Farmers sold the produce to the village traders. The marketing margins, price spread and cost in this channel are depicted in Table 2. The results revealed that producers received a net price of 736.00 ₹/q accounting for (37.74%) of consumer's price in Tauru market.

The total cost incurred by village trader was ₹ 134.50 per quintal which was (6.90%) of consumer rupee. Cost incurred by wholesaler cum commission agent was ₹ 47.69 per q which was (2.45%) of consumer rupee. Net margin earned by village trader and wholesaler cum commission agent was ₹ 124.50 and ₹ 112.31 per q, respectively. Cost incurred by retailer was ₹ 212.61 per quintal which was (10.90%) of consumer rupee. Net margin earned by retailer was ₹ 582.39 which was (29.87%) of consumer's rupee.

Channel -II: Producer →Wholesaler-cum-commission agent → Retailer →Consumer

In this channel, two intermediaries, i.e. wholesaler-cum-commission agent and retailer were involved between producers and ultimate consumers in the Nuh district of Haryana. Farmer sold his produce to the wholesaler-cum-commission agent. The marketing margins, price spread and cost in this channel are depicted in Table 2.

The results revealed that producers received a net price of ₹ 804.53 per q accounting for (45.97%) of consumer's price in Tauru market. The cost incurred by the producer in the marketing of the produce was ₹ 155.47 per q. Purchase price of wholesaler-cum-commission agent was ₹ 960.00 per q. Wholesaler-cum-commission agent sold the produce to the retailer and cost incurred by wholesaler-cum-commission agent was ₹ 47.69 per q. The sale price of wholesaler-cum-commission agent was ₹ 1165.00 per q. The net margin earned by wholesaler-cum-commission agent was ₹ 157.31 per q that accounted for (8.99%) of consumer's price in the market. The retailer incurred marketing cost of ₹ 213.41 per q in the market. Sale price of retailer or purchase price of consumer was ₹ 1750.00 per q. The retailer received net margin of ₹ 371.59 per q sharing about (21.23%) of the consumer's price in the market.

Channel- III: Producer → Retailer → Consumer

Table 2 shows the marketing margins, price spread and cost in the channel-III. The producer brings their produce in the market. Thus, only one intermediary, i.e. the retailer was involved between the producer and ultimate consumer. The producer's share as percentage of consumer's price was (64.53%). The marketing cost incurred by the producer was ₹ 155.47 per q and the sale price of producer for the produce

Table 2 Price spread of tomato in different channel in Tauru market of Nuh districts of Haryana (₹/q)

Particulars	Channel-I	Channel-II	Channel-III	Channel-IV
Net price received by producer/purchase price of village trader	736.00 (37.74)	804.53 (45.97)	1019.53 (64.53)	1339.53 (89.60)
Cost incurred by village trader/producer	134.50 (6.90)	155.47 (8.88)	155.47 (9.84)	155.47 (10.40)
i. Packing material	26.65 (1.37)	26.65 (1.52)	26.65 (1.69)	26.65 (1.78)
ii. Loading and unloading charges	30.00 (1.54)	30.00 (1.71)	30.00 (1.90)	30.00 (2.01)
iii. Transportation	55.17 (2.83)	52.59 (3.01)	52.59 (3.33)	52.59 (3.52)
iv. Spoilage and losses	22.68 (1.16)	22.68 (1.30)	22.68 (1.44)	22.68. (1.52)
v. Cost of grading		23.55 (1.35)	23.55 (1.49)	23.55 (1.58)
Sub-total (i-v)	134.50 (6.90)	155.47 (8.88)	155.47 (9.84)	155.47 (10.40)
Net margin of village trader	124.50 (6.38)			
Sale price of village trader/purchase price of wholesaler-cum-commission Agent	995.00 (51.03)	960.00 (54.86)		
Cost incurred by wholesaler cum-commission agent	47.69 (2.45)	47.69 (2.73)		
i. Loading and unloading	30.00 (1.54)	30.00 (1.71)		
ii. Spoilage and losses	17.69 (0.91)	17.69 (1.01)		
Sub-total (i-ii)	47.69 (2.45)	47.69 (2.73)		
Net margin of wholesaler cum-commission agent	112.31 (5.76)	157.31 (8.99)		
Sale price of wholesaler cum-commission agent/purchase price of retailer	1155.00 (59.23)	1165.00 (66.57)	1175.00 (74.37)	
Cost incurred by the retailer	212.61 (10.90)	213.41 (12.19)	118.21 (7.48)	
i. Commission @ 8%	92.40 (4.74)	93.20 (5.33)		
ii. Loading and unloading charges	30.00 (1.54)	30.00 (1.71)	30.00 (1.90)	
iii. Transportation	42.56 (2.18)	42.56 (2.43)	42.56 (2.69)	
iv. Spoilage and losses	47.65 (2.44)	47.65 (2.72)	45.65 (2.89)	
Sub-total (i-iv)	212.61 (10.90)	213.41 (12.19)	118.21 (7.48)	
Net margin of retailer	582.39 (29.87)	371.59 (21.23)	286.79 (18.15)	
Sale price of retailer/purchase price of consumer	1950.00 (100.00)	1750.00 (100.00)	1580.00 (100.00)	1495.00 (100.00)

Contd.

Table 2. (*Concluded*)

Particulars		Channel-I	Channel-II	Channel-III	Channel-IV
Marketting efficiency of tomato in different marketting channels					
Consumer purchase price (RP)	₹/q	1950.00	1750.00	1580.00	1495.00
Total marketing cost (MC)		394.80	416.57	273.68	155.47
Total net margin of intermediaries (MM)		819.20	528.90	286.79	
Net price received by farmers (FP)		736.00	804.53	1019.53	1339.53
Value added (1-4)		1214.00	945.47	560.47	155.47
Index of marketting efficiency					
Acharya's method (MME) (4÷2+3)	Ratio	0.61	0.85	1.82	8.62
Conventional method (E) (5÷2)		3.07	2.27	2.05	1.00
Shepherds method (ME) (1÷2)		4.94	4.20	5.77	9.62

was ₹ 1175.00 per q. Therefore, net price fetched by the producer was ₹ 1019.53 per q. Marketing cost incurred by the retailer was ₹ 118.21 per q purchase price of consumer was ₹ 1580.00 per q. The net margin earned by retailer was ₹ 286.79 per q that accounted for (18.15%) purchase price of the consumer.

Channel-IV: Producer→ Consumer

This was the shortest channel in tomato marketing with no intermediaries between producer and consumer. The producer sold their produce directly to ultimate consumers. The result presented in the Table 2 concludes that producer received a net price of ₹ 1335.23 per q accounting for (89.60%) of consumer price. The marketing cost incurred by the producer was ₹ 155.47 per q and the sale price of producer for the produce was ₹ 1495.00 per q.

Comparing the results, in different channels, it was observed that producer's share in consumer's rupee was highest in direct sale as compared to village trader, wholesaler-cum-commission agent and retailer. In the channel-I, II, III and IV net prices of producer were found (37.74%), (45.97%), (64.53%) and (89.60%) of consumer's rupee in the market, respectively. The producer's share in consumer's rupee was increased with decrease in the number of intermediaries between producer and consumer. The highest net price received by the producer in channel-IV (Producer to consumer) was found to be (89.60%) among all the channels. Our findings are similar to the findings of the study of Shende and Meshram (2015).

Marketing efficiency: Data (Table 2) shows that the marketing efficiency of tomato in different marketing channels for the year 2017–18. Marketing efficiency, according to Acharya's method, under different marketing channels, i.e. channel-I, channel-II, channel-III and channel-IV were 0.61, 0.85, 1.82 and 8.62, respectively.

From this efficiency index, it is clear that channel-IV was the most efficient among all marketing channels. Our findings are similar to the findings of the study of Kumar *et al.* (2016) and Kumar *et al.* (2021). This was because of the fact that in channel-IV, intermediaries were not involved. Marketing efficiency increased with the decreased in number of market intermediaries between producer and consumer. The marketing efficiency according to conventional method under different marketing channels, i.e. channels-I, channel-II, channel-III and channel-IV were 3.07, 2.27, 2.05 and 1.00, respectively. From this efficiency index, it is evident that channel-I was the most efficient among all marketing channels. The marketing efficiency according to Shepherd's method under different marketing channels, i.e. channels-I, channel-II, channel-III and channel-IV were 4.94, 4.20, 5.77 and 9.62, respectively. From this efficiency index, it is concluded that channel-IV was the most efficient among all the marketing channels.

Tomato is the world's largest vegetable crop and known as protective food because of its special nutritive value. The results concluded that the estimated total cost, gross return, net return, and B:C ratio of tomato cultivation were ₹ 183474, 289248, 105774 and 1.58 per ha, respectively. The value of B-C ratio was found more than one which indicated the cultivation of tomato crop was economically profitable. The cultivation of tomato crop also provided opportunities for employment of family and surplus labour in rural areas. Further study revealed that direct marketing of tomato was found to be most profitable, i.e. channel-IV (Producer to consumer) among all other marketing channels. As far as marketing efficiency was concerns, channel-IV was observed most efficient among all the channels. MIDH is being implemented to support vegetable growers for better access to production technologies, creation of infrastructure, Hi-Tech/protected cultivation technology and formation of FPOs for taking advantages of collective bargaining. State government has launched the risk mitigation scheme in 2018 to incentivize growers for four vegetable (potato, onion, tomato, cauliflower) crops in case of market price not covered the cost of production.

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